of voltaic electricity be transmitted through the lungs by those portions of the nerves which remain attached to them, no affection of the breathing supervenes, and the lungs after death are found quite healthy, unless the electricity has been applied of such power, or for so long a time, as to cause inflammation; in which case, the appearances on dissection are those of inflammation, and not those produced by mere division of the nerves.

On the Effects produced upon the Air Cells of the Lungs when the Pulmonary Circulation is too much increased. By Sir Everard Home, *Bart. V.P.R.S.* Read May 31, 1827. [*Phil. Trans.* 1827, *p.* 301.]

In examining the air cells of the lungs of a hare that had been coursed, the author found the superficial large cells filled with colourless coagulable lymph, forming white specks, and the smaller, more interior ones filled with coagula of red blood. No such appearance was seen in the lungs of hares, snared or shot. A run of fifteen minutes with greyhounds so exhausts the hare, that it is frequently known to die from over exertion before the dogs are able to reach it. To examine the state of the lungs, in which the white specks were seen, they were injected with mercury through the bronchiæ, and then immersed in rectified spirits to prevent them from collapsing, and in this state examined microscopically and drawn by Mr. Bauer. The drawings accompany the paper.

The white specks appear to be portions of coagulable lymph, separated from the circulating blood in consequence of its disturbed state, and the author considers them as giving great insight into the nature of that destructive disease called tubercles in the lungs; and in support of this idea quotes Dr. Baillie's description, and refers to his plates of them in his Morbid Anatomy.

Theory of the Diurnal Variation of the Magnetic Needle, illustrated by Experiments. By S. H. Christie, *Esq. M.A. F.R.S.* Read June 14 and June 21, 1827. [*Phil. Trans.* 1827, *p.* 308.]

Mr. Christie having been led to doubt the validity of the explanation of the moving easterly variation adopted by Canton, but at the same time having observed that the changes in deviation and intensity appear always to have reference to the position of the sun with regard to the magnetic meridian, was led to connect these phenomena with Professor Seebeck's discovery of thermo-magnetism, and Professor Cumming's subsequent experiments; and to refer the phenomena of diurnal variation to the effect of partial heating, modified, perhaps, by that of rotation, and by peculiar influence in the sun's rays.

In support of this opinion, he cites passages from papers by Professor Cumming and Dr. Traill, whom a similar idea appears also to have impressed. But in place of looking to the stony strata, of which the earth's surface consists, as the elements of the thermo-magnetic

apparatus which this doctrine requires, the author regards them as rather consisting of the atmosphere and the surfaces of land and water with which it is in contact. Thermo-magnetic phenomena, he remarks, have hitherto only been observed in metallic combinations, but this may be owing merely to the small scale on which our experiments are conducted.

To put to the test of experiment whether thermo-magnetism could be excited when the surfaces of two metals, instead of touching at one point, were in symmetrical contact throughout, the author first employed a compound ring of bismuth and copper, the copper outwards, and he found that to whatever point heat was applied, magnetic powers were developed, a needle being affected differently, according to the different positions in which the ring was placed with regard to it. After a lapse of two years from this first experiment, the author resumed the inquiry with an apparatus consisting of a flat ring of copper, having its inner circumference grooved and united firmly by soldering and fusion to a plate of bismuth cast within it; the whole forming a circular plate 12 inches in diameter, weighing 119 ounces troy, which was made to revolve in its own plane.

Heat was applied by a lamp to a given point at the circumference of this plate, and a delicately suspended needle, partly neutralized, was placed near it, and the deviations observed in all positions of the heated point, which was made to revolve (the lamp being withdrawn). These experiments led him to conclude that the effect of so heating a portion of the circumference, was to create a temporary polarity in the plate, the law of which he explains. He then details a set of experiments, by which he assured himself that a uniformity of action obtained wherever in the circumference the heat was applied. He next instituted a series of observations for determining the laws which govern the magnetic phenomena resulting from the application of heat, as above described, the results of which are stated in the form of tables. Four poles appeared to be produced, two north and two south; both the north lying in one semicircle, and both the south in the other, and not in alternate quadrants, and all the poles lying rather nearer to the centre than line junction of the two metals. The experiments were pursued in a variety of positions of the plate with respect to the meridian and horizon, and with a similar general result.

From these experiments, the author concludes, that uniformity of junction of the two surfaces of a thermo-magnetic combination is no obstacle to the development of transient polarity. Regarding the earth and the atmosphere as such a combination, and limiting our views to the intertropical zone alone, we should have two magnetic poles produced on the northern, and two on the southern side of the equator, similarly pointed, the poles of the opposite names being diametrically opposed to each other.

To apply this to the earth, it is necessary to know the times of greatest heat in the twenty-four hours: this may be assumed at three o'clock in the afternoon. The apparatus used by the author not

affording, when adjusted to the latitude of the place, sufficient magnetic power to render the effects distinct, he substituted for it an artificial imitation, consisting of two magnets six inches long, so placed, with respect to a revolving axis parallel to the axis of the earth, as to imitate the position of the poles produced by thermo-magnetism in his plate; and making the apparatus revolve round this axis, noticed the deviations produced thereby on a compass placed horizontally over it. These deviations he then compares at length with those actually observed, 1stly, by Lieutenant Hood, in 1821, at Fort Enterprise, lat. 64° 28′ N.; 2ndly, by Canton in London, in 1759; 3rdly, by Lieutenant Foster at Port Bowen, in 1825; 4thly, by Colonel Beaufoy at Bushy Heath, in 1820. The results of this comparison are on the whole generally such as to indicate a conformity between the hypothesis and fact, with the exception of some deviations from the exact times of maximum and minimum variation, which could not but be expected. Those observations which afford the least support to the hypothesis are those at Port Bowen; but the case is so extreme, with a dip of 88°, that the author does not regard them as essentially opposed to it, as modifying circumstances must here have an overpowering influence.

The author then considers the manner in which the distribution of land and sea over the globe modifies the point of greatest heat, and in consequence the place of the diurnal poles. He then observes, that at the commencement of his experiments he had no idea of being able to reduce the deviations of the needle to so simple a law as that resulting from a polarity in a particular direction, communicated to the plate, but that he considered it of the greatest consequence to ascertain whether the deviations at the outer edge of his plate had the same general character with those within, at the line of junction of the metals; since these situations of the needle would correspond to great elevations in the atmosphere and points near the earth's surface, respectively as the character of the deviations turns out to be the same in both cases; so that in this respect the hypothesis, so far as is known, agrees with observation.

Mr. Christie proposed prosecuting these experiments with a hollow copper shell filled with bismuth; but from unequal thickness of the copper, and imperfect contact, his experiments proved less uniform and satisfactory in their results. One general effect, however, afforded a striking correspondence with nature. The whole equator being heated, and one part more than the rest, he uniformly found that, the elevated pole being towards the north, the north end of the needle deviated west, when the place of heat was on the meridian above the horizon, and east, when below it; which is precisely the character of the diurnal variation, north latitude.